

Chapter 21

Genitourinary Tract

Introduction

The majority of pediatric patients with genitourinary trauma will have concomitant injuries (abdomen, thorax, spine, pelvis, femur). The management of genitourinary injuries in children is similar to that for adults; this chapter focuses primarily on the differences in management.

Trauma

- Renal injuries
 - Children are believed to be more susceptible to renal injury than adults
 - Preexisting renal anomalies (ureteropelvic junction [UPJ] obstruction, hydroureteronephrosis, horseshoe kidney) are 3–5 times more common in children undergoing evaluation for renal trauma than in adults
 - Children with preexisting renal anomalies are frequently noted to have hematuria out of proportion to the injury; however, the degree of injury is comparable to that in those without anomalies
 - Significant renal injury may be present in children without hematuria; up to 70% of children with grade 2 or higher renal injury will not have hematuria
 - Indications for renal imaging after abdominal trauma
 - ▶ Significant deceleration injury
 - ▷ High speed motor vehicle accident
 - ▷ Pedestrian struck by a car
 - ▷ Fall > 15 ft
 - ▷ Striking of flank with a foreign object
 - ▶ Associated injuries
 - ▷ Fractures of thoracic rib cage, spine, pelvis, or femur
 - ▷ Bruising of torso or perineum
 - ▷ Peritoneal signs
 - ▷ Gross hematuria

- Microscopic hematuria with systolic blood pressure < 90 mmHg at any time
- Imaging
 - Focused assessment with sonography for trauma (FAST) examination
 - This fails to detect 5%–10% of clinically significant liver, spleen, kidney, adrenal, and small bowel injuries
 - A negative FAST examination **and** normal serial physical examinations over 24 hours rule out significant intraabdominal injury
 - Computed tomography (CT) scan
 - Stabilized patient: triphasic (precontrast, immediately following injection, and 15–20 min delayed)
 - Labile patient: single phase immediately following injection will miss ureteral injury or urinary extravasations
 - Severely unstable patients: intraoperative
 - Verify the presence of a functioning contralateral kidney prior to performing trauma nephrectomy
 - Administer a single shot intravenous (IV) pyelogram using 2 mL/kg IV contrast; perform a radiograph of the kidneys, ureters, and bladder at 10–15 minutes
- Management
 - Grade
 - 1: contusion/subcapsular hematoma
 - 2: < 1 cm laceration
 - 3: > 1 cm laceration and/or devitalized fragments
 - 4: laceration with urinary extravasation or major renovascular injury, controlled hemorrhage
 - 5: shattered kidney/hilar avulsion/major renovascular injury with uncontrolled hemorrhage
 - Indications for nonsurgical management
 - Patient is hemodynamically stable, grade 1 or 2, with or without associated abdominal injury
 - Isolated grade 3 or 4, provided the distal ureter is intact
 - A hemodynamically stable, grade 5 injury
 - Treatment

- ▷ Monitor bed rest (urine output, vital signs) until gross hematuria has resolved
- ▷ Perform serial physical examinations and hematocrit measurements
- ▷ Administer antibiotics
- ▷ 2–3 days after injury, reimage grade 3, 4, and 5 injuries that were managed nonoperatively
- Operative intervention
 - ▶ Relative indications
 - ▷ Ongoing hemorrhage (consider embolization)
 - ▷ Urinary extravasation and progressive pain or ileus
 - ▷ Ureteral stent or percutaneous drainage of urinoma
 - ▷ No strenuous activity for 6 weeks
 - ▶ Absolute indications for operative intervention
 - ▷ Hemodynamic instability due to renal source
 - ▷ Expanding/pulsatile retroperitoneal hematoma
 - ▷ Unsuccessful attempt at angioinfarction
 - ▷ Renal exploration (operative technique equivalent to adults)
 - ▷ Coexisting abdominal injuries and grade 3 or greater renal injury
 - ▷ Unstable patient with inadequate preoperative staging and finding of retroperitoneal hematoma at exploration
 - ▶ Principles of renal exploration
 - ▷ Verify function of the contralateral kidney before exploration
 - ▷ Obtain control of the renal vessels prior to exploration
 - ▷ Repair the renal injury
 - ▷ Keep drainage separate from coexisting injuries
 - ▷ Separate intraabdominal and retroperitoneal injuries using omentum
- UPJ disruption
 - CT scan findings
 - ▶ Good renal contrast excretion with medial perirenal extravasation
 - ▶ No parenchymal laceration
 - ▶ Nonvisualization of ipsilateral ureter on delayed images

- Treatment
 - ▶ Retrograde pyelogram to evaluate continuity of the UPJ
 - ▷ If the UPJ is intact and there is a renal parenchymal or pelvic laceration, place a ureteral stent; nephrostomy may be indicated
 - ▷ If the UPJ is disrupted and the problem is diagnosed **within 5 days**, perform immediate surgical repair
 - Debride devitalized tissue
 - Spatulate and reanastomose the ureter to the renal pelvis with fine, absorbable suture over a ureteral stent (5–6 French size [Fr]) or feeding tube
 - Place an intraoperative nephrostomy tube and retroperitoneal drain
 - Mobilize the kidney for a tension-free anastomosis, if necessary
 - ▷ If the UPJ is disrupted and problem is diagnosed **after 6 days**
 - Perform nephrostomy
 - Reassess after 12 weeks
 - Perform retrograde pyelogram and functional imaging
- Ureteral injury
 - Accounts for < 4% of penetrating injuries in children
 - Mortality rate of > 30% is related to concomitant injuries
 - Two thirds of cases do not have hematuria
 - High-velocity injury produces a blast effect
 - Ureter may appear intact at exploration
 - Delayed necrosis leads to urinary extravasation
 - Presentation: urine output from surgical drains 3–5 days after injury
 - Management
 - ▶ Within 5 days of injury: perform a primary repair
 - ▷ Remove devitalized tissue
 - ▷ Spatulate and perform tensionless anastomosis over a stent with a fine, absorbable suture
 - ▷ Use renal mobilization or a bladder flap to relieve tension
 - ▶ In an unstable patient or in the presence of extensive in-

jury, occlude the ureter with a large clip at the proximal end and place a nephrostomy tube for delayed repair

- Bladder injury
 - Frequently associated with multiorgan trauma
 - Absolute indications for surgical repair
 - ▶ Gross hematuria and pelvic fracture
 - ▶ Inability to void
 - Relative indications for surgical repair
 - ▶ Clot retention
 - ▶ Perineal hematoma
 - Image using cystogram
 - ▶ Instill at least $\frac{1}{2}$ estimated bladder capacity under gravity via urethral catheter (bladder capacity = $[\text{age} + 2] \times 30$; Table 21-1)

Table 21-1. Urethral Catheter Size Estimation*

Age	Size (Fr Feeding Tube [†] or Foley Catheter)
Newborn	5
3 mo	8
1 y	8–10
3–6 y	10
8 y	10–12
10 y	12
12 y	12–14
Teenager	16+

*In males, use a tube that fits the meatus, the narrowest part of the male urethra.

[†]A French-sized feeding tube may be used if a Foley catheter is unavailable or if the Foleys available are too big.

- ▶ Standard cystogram
 - ▷ Plain film
 - ▷ Contrast film
 - ▷ Drain film
- ▶ CT cystogram
 - ▷ Only requires fill film
 - ▷ Dilute contrast by $\frac{1}{4}$ to $\frac{1}{3}$
 - ▷ Must fill bladder, not just clamp catheter
- Treatment

- ▶ Administer antibiotics until 48 hours after the catheter is removed
- ▶ Explore and repair extraperitoneal region
- ▶ If CT scan shows a bone spicule in the bladder or if there is bladder neck injury,
 - ▷ Small children, particularly boys, will need a large-caliber suprapubic tube (SPT; a small urethral catheter will not drain clots)
 - ▷ Drain 7–10 days, then reimaging
- ▶ If no bone spicules are evident and bladder neck injury is ruled out, place an indwelling catheter and observe
- ▶ Intraperitoneal
 - ▷ Free intraabdominal fluid will be visible on CT scan
 - ▷ Diagnose with intraperitoneal contrast on cystogram
 - ▷ Explore and repair
- ▶ Transvesical approach
 - ▷ Identify and spare ureteral orifices
 - ▷ Use absorbable suture in 2-layer closure
 - ▷ Place a large-bore urinary catheter (SPT for boys and small girls to allow large bore) and/or Foley catheter
 - ▷ Place perivesical drain
 - ▷ Perform cystogram at 7–10 days prior to catheter removal
 - ▷ Bladder injury in children is twice as likely to involve the bladder neck than it is in adults
 - If bladder neck is not repaired, patient will likely sustain persistent urinary extravasation
 - Bladder neck injury increases incontinence risk
 - Suspect a bladder neck injury if there is contrast extravasation and an incompetent bladder neck is apparent on cystogram
- ▶ Repair of bladder neck injury
 - ▷ Open bladder at dome
 - ▷ Use care to avoid disrupting a pelvic hematoma
 - ▷ Use an intravesical closure (absorbable) suture in multiple layers with suprapubic and urethral catheter drainage
 - ▷ Perform retrograde urethrogram or cystoscopy to

- ▶ assess for urethral injury
 - ▶ Place urethral and suprapubic catheters
- Urethral injury
 - Children versus adults
 - ▶ Pelvic fracture is more likely to be unstable in children than in adults, displacing the prostatic urethra
 - ▶ Complete posterior urethral disruption is more common in boys than men
 - ▶ There is a 20% incidence of both bladder and urethral injuries in children
 - ▶ Prepubertal girls are 4-fold as likely to have urethral injury with a pelvic fracture than adult women
 - Imaging
 - ▶ Indications
 - ▷ Perineal/penile hematoma
 - ▷ Blood at meatus/introitus
 - ▷ Inability to void
 - ▷ One or more pubic rami fractures **or** symphyseal diastasis
 - ▷ Evidence of bladder neck injury
 - ▶ Males
 - ▷ Perform retrograde urethrogram
 - ▷ Insert a 6 Fr or 8 Fr Foley catheter, with balloon gently inflated with approximately 1 cc, in the fossa navicularis and perform retrograde instillation of 10–15 cc contrast with an oblique film, visualizing contrast into the bladder
 - ▶ Females
 - ▷ Anesthetize patient and perform vaginoscopy or cystoscopy
 - ▷ For prepubertal girls, use a nasal speculum or cystoscope
 - Urethral injury combined with pelvic fracture mandates a rectal examination
 - ▶ Blood in stool indicates a potential occult rectal injury
 - ▶ Treat the rectal injury with diversion
 - Urethral injury in girls
 - ▶ Invariably associated with a pelvic fracture
 - ▶ 75% are associated with a vaginal injury

- ▶ 30% are concurrent with rectal injury
- Treatment
 - ▶ Administer broad-spectrum antibiotics
 - ▶ Assess bladder neck
 - ▶ Establish urinary drainage with an urethral catheter or suprapubic tube; vesicostomy is a diversion option in infants
 - ▶ Make a small transverse incision between the pubis and the umbilicus, mobilize and open dome of the bladder, and mature stoma to rectus fascia and skin
 - ▶ Encourage gentle passage of urethral catheter (if disruption is not complete) to establish continuity; abort if passing the catheter is difficult
 - ▶ Repair small lacerations of the anterior urethra with fine, absorbable suture
- External genital injuries
 - Management of penile, scrotal, and testicular injuries is equivalent to that of adults
 - Evaluate for concomitant rectal injury in the presence of penetrating scrotal or vulvar trauma
 - Perform meticulous examination under anesthesia to assess depth and extent of wound, debridement of nonviable tissue, and evidence of concomitant injuries
 - In the presence of associated hematuria or blood on rectal examination, evaluate for urethral injury or rectal injury, respectively

Conditions of the Genitourinary Tract

- Urinary tract infection (UTI)
 - Diagnosis
 - ▶ Neonates
 - ▷ Symptoms include jaundice, failure to thrive, and fever
 - ▷ Laboratory tests: bacteriuria
 - ▶ Older children
 - ▷ Symptoms: dysuria, urgency, frequency, enuresis
 - A positive bagged urine culture should be confirmed by a specimen obtained by suprapubic aspiration
 - UTI: > 105 colonies/mL of a single bacterial species

- ▶ Accuracy
 - ▷ 80% in a bagged specimen
 - ▷ 95% in a catheterized specimen
 - ▷ 99% in a specimen obtained from suprapubic aspiration
- White blood cells in urine are suggestive of UTI
- Nitrite test: nitrate that is normally present in urine is converted to nitrite by bacteria
- Classification
 - ▶ Upper tract infection (pyelonephritis)
 - ▷ Symptoms: fever, flank pain or tenderness, increased white blood cell count
 - ▷ Treatment: IV antibiotics
 - ▶ Lower tract infection
 - ▷ Diagnosis: suprapubic aspiration, catheterized specimen
- Epidemiology
 - ▶ Neonates: occurs more frequently in males than females (due to congenital abnormalities)
 - ▶ Other ages: more common in females than males; incidence increases with age in both sexes
- Pathophysiology
 - ▶ Protective factors
 - ▷ Regular complete bladder emptying (avoid urine stasis)
 - ▷ Antimicrobial activity of urothelium (urothelial cells secrete a mucopolysaccharide coating, which traps bacteria)
 - ▷ Acid pH, high urinary osmolality
 - ▶ Potentiating factors
 - ▷ Urinary stasis
 - ▷ Vesicoureteral reflux
 - ▷ Urolithiasis
 - ▷ Obstruction
 - ▷ Periurethral colonization (usually with gut flora)
 - ▷ Phimosis
 - ▷ Bacterial factors
 - O (lipopolysaccharide), K, H antigens
 - Hemolysins
 - Urease produces alkalization of urine, resulting

in stone formation

- Laboratory findings
 - ▶ 50% of patients < 12 years old with a UTI have associated urinary tract abnormalities
 - ▶ If culture from urinary analysis (suprapubic in infants, midstream clean catch or straight catheter in older patients) is positive, proceed to ultrasound and voiding cystourethrography
- Treatment
 - ▶ Ampicillin + gentamicin for 7 days
 - ▶ Hydration

Penis

- Foreskin retractility
 - Newborn (term): usually not retractile
 - 6 months: 20%
 - 6 years: 40%
 - 13 years: 100%
- Hypospadias
 - Urethral meatus opens onto the ventral surface of the penis, proximal to the end of the glans
 - Associated anomalies include inguinal hernia and undescended testicles
 - Usually repaired in first year of life
 - Most commonly glandular (subcoronal)
 - May be associated with ventral curvature (ie, chordee)
 - Avoid circumcision to facilitate reconstruction; perform meatal advancement and glanuloplasty procedure
- Epispadias
 - Urethral meatus opens onto the dorsal surface of the penis, proximal to the end of the glans
- Phimosis
 - Physical: male foreskin cannot be fully retracted from the head of the penis (normal in infancy)
 - Etiology: congenital or acquired from recurrent infections of the foreskin (balanitis)
 - Complications include impairment or obstruction to urinary flow and paraphimosis (see page 255)
 - Treatment: circumcision

- Paraphimosis
 - Physical: the foreskin becomes trapped behind the glans penis and cannot be pulled back to its normal position
 - Complications include constriction of blood supply to the glans
 - Treatment options
 - ▶ Compress the glans and move the foreskin back to its normal position
 - ▶ Make a dorsal slit in the foreskin or perform circumcision
 - ▶ Make multiple needle punctures in the swollen foreskin and express the edema fluid using manual pressure
 - Prevention: pull the foreskin back over the glans after it has been retracted (eg, to insert a Foley catheter)
- Circumcision
 - Surgical indications for circumcision
 - ▶ Definite
 - ▷ Phimosis
 - ▷ Paraphimosis
 - ▷ Recurrent balanitis
 - ▶ Relative: recurrent UTI
 - Techniques
 - ▶ Freehand
 - ▶ PlastiBell (Hollister, Inc, Libertyville, Ill)
 - ▶ Gomco clamp
 - ▶ Mogen clamp
 - Complications
 - ▶ Bleeding
 - ▶ Infection
 - ▶ Urethral injury
 - ▶ Removal of too much/too little foreskin

Testicular and Scrotal Conditions

- Undescended testes (UDT)
 - Definitions
 - ▶ Retractable testis
 - ▷ Etiology: overactive cremasteric muscle
 - ▷ Testis can be brought into scrotum by careful manipulation

- ▷ Usually bilateral
- ▷ Testis remains in scrotum after onset of puberty
 - Testicle becomes heavier and larger than the external inguinal ring
 - Cremaster becomes less active
- ▶ Cryptorchidism
 - ▷ Testis does not descend into scrotum due to inadequacy or maternal gonadotrophic hormones
 - ▷ Associated with abnormal spermatogenesis
 - ▷ The higher the position of the testis, the more abnormal
 - ▷ Most fail to reach scrotum because spermatic artery is too short
- ▶ Ectopic
 - ▷ Testis is located in an abnormal position (thigh, groin)
 - ▷ Results from abnormally positioned gubernaculum
 - ▷ Increased risk for trauma
 - ▷ Treatment: orchidopexy by 1–2 years of age
- ▶ Anorchism
 - ▷ Absent testis resulting from torsion or infarction during fetal life
 - ▷ Ultrasound and laparoscopy aid in diagnosis
 - ▷ Treatment involves surgical exploration; dysplastic or intraabdominal testes have a high incidence of malignant degeneration
- ▶ Polyorchism: > 2 testes
- Embryology
 - ▶ Testicular descent through the internal ring starts at 30 weeks
 - ▶ Failure to descend can result from:
 - ▷ Inadequate gonadotrophic hormones (testosterone)
 - ▷ Failure of end organ (testis) response to testosterone
- Pathology
 - ▶ Location of UDT: anywhere from the renal hilum to the external inguinal ring
 - ▶ Smaller, softer, and more elongated than normal testes
 - ▶ 90% have an associated hernia sac
 - ▶ Testicular degeneration begins after the second year of age
 - ▶ Unilateral UDT may produce autoantibodies that injure

the other testis

- Incidence (similar to inguinal hernias)
 - ▶ Right side: 50%
 - ▶ Left side: 25%
 - ▶ Bilateral: 25%
 - ▶ 10-fold more common in premature infants
- Differential diagnosis: retractile testis
- Indications for operation
 - ▶ Spermatogenesis
 - ▷ Cryptorchid testis is exposed to increased temperature, resulting in decreased spermatogenesis
 - ▷ Determinants of degree of testicular damage
 - Length of exposure
 - Degree of nondescent
 - ▷ Unilateral: associated with approximately normal fertility if corrected before 2 years of age
 - ▷ Bilateral: usually results in sterility
 - ▷ Optimal age for repair is 1–2 years of age
 - ▶ Malignant change
 - ▷ May be more common in UDT
 - ▷ Orchidopexy has not been shown with certainty to influence the incidence of malignancy, but does permit earlier detection (average age at the time of diagnosis is 26 y old)
 - ▷ Tumor development (seminoma, teratocarcinoma, embryonal); orchiopexy makes it easier to examine for a malignant tumor
 - ▷ Children > 14 years old with unilateral UDT should undergo orchiectomy
 - ▶ Increased risk of trauma and torsion in UDT
 - ▶ Cosmetic and psychological considerations
- Treatment
 - ▶ Rationale for orchiopexy
 - ▷ Enhances fertility
 - ▷ Decreases risk of torsion
 - ▷ Repairs coexistent hernia
 - ▷ Prevents trauma
 - ▷ Makes it easier to examine for the presence of a testicular tumor, permitting earlier detection

- ▶ Surgical treatment
 - ▷ Optimal time for surgery is at 1–2 years of age
 - ▷ Technique: formation of a dartos pouch
 - ▷ Limiting factor: length of spermatic artery
 - ▷ If testis is not palpable, perform laparoscopy
 - ▷ Testis present
 - First stage Fowler-Stevens (laparoscopic): ligate (clip) the spermatic artery and vein high in the retroperitoneal space; testicular blood supply is then derived from vessels to the vas, deep epigastric collaterals, and processes vaginalis; place testicle as low as possible in the scrotum at this first operation
 - Second stage Fowler-Stevens (at 6–12 mo of age): bring testicle down into scrotum
 - ▷ Testes absent (“anorchia”)
 - Diagnose by identifying a blind-ending vas and vessels (using laparoscopy)
 - Treatment: close
 - ▷ Atrophic/dystrophic testes
 - Biopsy to confirm
 - Orchiectomy if contralateral testis is normal (usually performed after onset of puberty)
 - ▷ Testis palpable in canal
 - Perform orchiopexy
 - Testosterone production will be unchanged after orchiopexy
 - Perform orchiectomy only if patient is > 14 years of age (ie, after onset of puberty)
- ▶ Results
 - ▷ Injury to vas (uncommon)
 - ▷ Injury to spermatic vessels may cause atrophy
 - ▷ Patients with uncorrected bilateral UDT are infertile
 - ▷ 70% of patients with bilateral UDT corrected < 2 years of age are fertile
- Acute conditions of the scrotum
 - Torsion
 - ▶ Most common genitourinary emergency of childhood

- ▶ Occurs in late childhood to early adolescence, predominantly before age 6, peaking at age 14
- ▶ Pathology: twisting of the testicle on its blood supply, which may result in infarction
- ▶ Differential diagnosis
 - ▷ Major
 - Torsion of testis (torsion of appendix testis)
 - Epididymitis
 - Orchitis
 - Trauma
 - Tumor
 - Hemorrhage
 - ▷ Minor
 - Idiopathic scrotal edema
 - Hernia/hydrocele
- ▶ Types
 - ▷ Extravaginal: occurs in perinatal period
 - ▷ Intravaginal: due to lack of testicular fixation in tunica ("bell-clapper anomaly"); occurs at birth
- ▶ Symptoms of torsion
 - ▷ Scrotal pain
 - Abrupt onset suggests testicular torsion; acute scrotal pain must be considered torsion of the testicle until proven otherwise
 - Gradual (12–24 h) onset suggests torsion of the appendix testis; pain radiates upward toward groin and lower abdomen
 - History: prior transient episodes of testicular pain with spontaneous resolution
 - Physical: red, painful, tender scrotum; testis is enlarged, tender, and elevated within scrotum
 - Pain is increased when scrotum is lifted
 - ▷ Associated abdominal and gastrointestinal symptoms include nausea, vomiting, and lower quadrant abdominal pain
 - ▷ Differential diagnosis: localization of tenderness to particular scrotal structures
- Neonatal torsion
 - ▶ Pathology

- ▷ True torsion of the spermatic cord
- ▷ Extravaginal (outside the tunica vaginalis) torsion
- ▶ Usually results in complete infarction, requiring orchiectomy
- ▶ Probable etiology of “vanishing testis” syndrome (unilateral anorchia)
- ▶ Extravaginal etiology
 - ▷ Inadequate fixation of testis, resulting in twisting of the cord structures and infarction
 - ▷ Usually occurs in neonates
- ▶ Intravaginal or bell clapper deformity
 - ▷ Abnormally high reflection of the tunica vaginalis upward from its usual, more equatorial position about the testicle to a level of attachment to the spermatic cord itself
 - ▷ Leaves the testicle hanging (like the clapper of a bell) within the tunica vaginalis, able to spin freely around the long axis of the spermatic cord
- ▶ Laboratory tests
 - ▷ Complete blood count
 - ▷ Urinary analysis will show increased white blood cell count
 - ▷ Use Doppler flow study to assess blood flow to testicle and differentiate ischemia (torsion) from an inflammatory process (epididymitis; see following page)
 - ▷ Use technetium-99m scan
 - Torsion will reveal a halo of increased activity around the scrotum surrounding a cold center (ischemic testicle)
 - Epididymitis and torsion of appendix testis will show markedly increased blood flow to affected side
- ▶ Treatment
 - ▷ Sedate and attempt manual detorsion
 - ▷ Perform prompt bilateral orchidopexy
 - Use midline scrotal raphe incision
 - Suture tunica albuginea to scrotal wall using four nonabsorbable sutures

- ▷ If torsion is present for > 12 hours or is necrotic,
 - Perform orchiectomy (necrotic testes may produce autoimmune antibodies)
 - Apply testicular prosthesis at a later time (~ 6 mo of age)
- ▷ If torsion is present at birth, stabilize the baby before exploration (salvage is not possible)
- ▶ Prognosis
 - ▷ Increased risk of impaired spermatogenesis and infertility
 - ▷ < 6 hours: 90% chance of salvage
 - ▷ 6–12 hours: 75% chance of salvage
 - ▷ 12–24 hours: 50% chance of salvage
 - ▷ > 24 hours: < 10% chance of salvage
- Torsion of appendix testis
 - ▶ Physical: transillumination may reveal the “blue dot” sign
 - ▶ Treatment
 - ▷ Bed rest, scrotal support, and analgesics
 - ▷ Operative intervention if symptoms persist > 2–3 days
 - ▷ If torsion of the testis cannot be distinguished from appendix testis by physical examination or Doppler ultrasound, prompt surgical exploration is indicated
- Epididymitis
 - ▶ Etiology
 - ▷ Reflux of urine up the vas to epididymis, inciting an inflammatory response
 - ▷ Sexually transmitted disease (usually gonococcus or chlamydia)
 - ▶ Symptoms
 - ▷ Pain is decreased when scrotum is lifted (Prehn sign)
 - ▷ Urinary tract symptoms associated with epididymitis (usually seen in postpubertal boys) include urinary frequency, dysuria, and pyuria
 - ▶ Diagnosis and laboratory tests
 - ▷ Urinary analysis will reveal bacteria
 - ▷ If urine culture is positive in a nonsexually active male, rule out congenital urinary tract anomaly
 - ▷ Perform renal ultrasound to rule out hydronephrosis
 - ▷ Perform voiding cystourethrography to rule out

bladder outlet obstruction

- ▶ Treatment: antibiotics for chlamydia (doxycycline), analgesics
- Orchitis
 - ▶ Etiology: usually due to a viral infection (eg, mumps)
 - ▶ Physical: scrotal skin is erythematous and edematous, white blood cell count is increased, urinary analysis is normal, ultrasound shows good blood flow to testis
 - ▶ Treatment: bed rest, observation
 - ▶ Associated with decreased fertility
- Varicocele
 - ▶ Most common on left (left spermatic vein drains into the left renal vein)
 - ▶ Etiology
 - ▷ Idiopathic: incompetent venous valves
 - ▷ Obstruction of renal vein
 - Left renal vein thrombosis
 - Retroperitoneal tumor
 - ▶ Symptoms
 - ▷ Pain
 - ▷ Testicular atrophy
 - ▷ Decreased fertility (due to increased temperature)
 - ▶ Diagnosis: ultrasound
 - ▶ Treatment
 - ▷ Measure dimensions of the testicle; atrophy and pain are the primary indications for operation
 - ▷ Perform laparoscopic, retroperitoneal ligation of the spermatic veins and artery

Tumors

- Most common testicular tumors in childhood include teratomas, yolk sac tumors, rhabdomyosarcoma, and lymphoma
 - Physical: solid scrotal mass
 - Diagnosis: radiograph, α -fetoprotein, β -human chorionic gonadotrophin
 - Treatment
 - ▶ Inguinal incision (**note: never approach through a scrotal incision!**)
 - ▶ Clamp and individually ligate cord structures at the internal ring

- ▶ Deliver testicle
- ▶ Perform high inguinal orchiectomy if a neoplasm is present

Vaginal Conditions

- Labial fusion (labial adhesions)
 - Etiology: chronic irritation, lack of estrogen stimulation
 - Symptoms: difficulty urinating
 - Diagnosis: labia minora are fused on physical examination
 - Treatment
 - ▶ Incision under general anesthesia
 - ▶ Topical estrogen cream once a day for 30 days
 - ▶ Gentle separation in office after application of lidocaine jelly or lidocaine/prilocaine cream
 - ▶ Prevention: maintain good hygiene
- Vaginitis
 - Etiology
 - ▶ Prepuberty: allergy/irritation due to bubble bath or laundry detergent is most common
 - ▶ Postpuberty: infections; **rule out child abuse**
 - ▶ Foreign body
 - Diagnosis: vaginoscopy
 - Treatment: removal of foreign body or irritant; antibiotics for infection
- Pelvic inflammatory disease
 - *Neisseria gonorrhoeae* is the most common cause
 - *Chlamydia trachomatis* is increasing in incidence as an etiology

